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Rocky Flats Plant

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Monthly Environmental Monitoring Report

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A prime contractor to the
United States Department of Energy

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Executive Summary

The Rocky Flats Plant is part of a nationwide Department of Energy complex for the research, development, and production of nuclear weapons. The plant is responsible for fabricating nuclear weapons components from plutonium, uranium, beryllium, and stainless steel. Primary production activities include metal fabrication and assembly, chemical recovery and purification of process-produced transuranic radionuclides, and related quality control functions.

Because radioactive and chemically hazardous materials are used or handled at the Rocky Flats Plant, the plant maintains an extensive environmental protection program. Included in that program is regular monitoring for radioactive and hazardous constituents at onsite, plant boundary, and offsite locations. This Environmental Monitoring Report provides a monthly summary of environmental monitoring data collected by the Rocky Flats Plant. Summarized below are highlights from the major data categories presented. Remaining data presented in this report are within the ranges historically measured for their respective parameters and locations.

Radiation standards for protection of the public are discussed in Appendix A of this report. The primary standards are based on calculations of radiation dose. These calculations are performed annually using monitoring data presented in the Monthly Environmental Monitoring Report. Radiation doses to the public from Rocky Flats Plant operations are typically well below any regulatory limit and far less than are received from naturally occurring radiation sources in the Denver metropolitan area (see Appendix A).

March 1992 Monitoring Data - Reporting of air effluent data, ambient air data, and most of the onsite and offsite surface water monitoring data continues to be delayed because of damage to the Health and Safety Analytical Laboratory fume hoods during the severe blizzard that occurred March 8-9, 1992. A lightning strike to an RFP transformer resulted in the burnout of fan motors for the hoods. In addition, Rocky Flats Plant still is in the process of implementing changes begun in the month of January to the data management system used for processing environmental samples. Total long-lived alpha and beta activity screening, which is performed on air effluent sample filters and surface water discharge samples prior to radiochemical processing and analysis, is continuing on schedule.

No unusual results have been seen in this screening. Analytical results for all samples will be reported when available.

Ponds A-4 and C-2 were discharged during March 1992. Pond B-3 was discharged from March 3 - 8 and March 10 - 31. Pond B-3 was not discharged on March 9 because of the blizzard. As has been done in the past, water from Pond C-2, discharged March 24 - 31, was pumped to the Broomfield Diversion Ditch for the discharge.

March 1992

Rocky Flats Plant Environmental Monitoring Report

Introduction

This report summarizes the effluent and environmental monitoring programs at the Rocky Flats Plant (RFP) for the month of March 1992. The data presented herein reflect the best information available to the RFP at this time. Should subsequent analyses indicate that any data presented herein are inaccurate or misleading, appropriate revisions will be issued promptly.

Tables 1 through 3 show monitoring results for radioactive and nonradioactive airborne effluents continuously sampled from plant buildings. Tables 4 through 6 summarize environmental monitoring data from the RFP ambient air sampling network. This network is comprised of continuously operating outdoor air samplers located on plantsite, around the plant boundary, and in neighboring communities.

Water sampling results for radioactive constituents are given in Tables 7 through 11. Results are summarized for plant surface water control ponds, for nearby drinking water reservoirs, and for tap water for neighboring communities. Nitrate monitoring for Great Western Reservoir and Standley Lake, the two drinking water reservoirs that can receive surface water discharges from the plant, are summarized in Table 12. Surface water discharges from RFP currently are being diverted around these drinking water reservoirs.

The Environmental Protection Agency (EPA) has issued to the plant a National Pollutant Discharge Elimination System (NPDES) permit for control of surface water discharges. Water sampling results associated with the NPDES permit, as modified by a March 25, 1991, Federal Facilities Compliance Agreement (FFCA) with EPA, are reported in Table 13. Applicable NPDES/FFCA limits are included in Table 13 for comparison. Monitoring results for which no limits have been established under the NPDES/FFCA are reported in Table 14. Appendix B

lists the volatile organic compounds for which monitoring is required under the NPDES/FFCA. Analytical results for nonradioactive parameters in water at the Walnut Creek at Indiana Street location are summarized in Table 15. Daily flow data for surface water from the two plant drainage systems (Walnut Creek and Woman Creek) are given in Tables 16 and 17. Daily flow data for water transferred from Pond B-5 to Pond A-4, for subsequent discharge offsite, are given in Table 18. Meteorological data are given in Tables 19 and 20.

Appendix D contains corrections and updates on previously reported information.

Error terms in the form of "a±b" are included with some of the data. For a single sample, "a" is the analytical-blank corrected value; for multiple samples it represents the arithmetic mean, the volume-weighted mean, or the annual total, as indicated in the table. The error term "b" accounts for the propagated statistical counting uncertainty of the sample(s) and the associated analytical blanks at the 95 percent confidence level. These error terms represent a minimum estimate of error for the data.

Plutonium, uranium, americium, tritium, and beryllium measured concentrations are given in this report. Most of the measured concentrations are at or very near background levels, and often there is little or no amount of these materials in the media being analyzed. When this occurs, the results of the laboratory analyses can be expected to show a statistical distribution of positive and negative numbers near zero and numbers that are less than the calculated minimum detectable concentration for the analyses. The laboratory analytical blanks, used to correct for background contributions to the measurements, show a similar statistical distribution around their average values. Negative sample values result when the measured value for a laboratory analytical blank is subtracted from a sample analytical result smaller than the analytical blank value. Results that are less than calculated minimum detectable levels indicate that the results are below the level of statistical confidence in the actual numerical values. All reported results - including negative values and values that are less than minimum detectable levels - are included in any arithmetic calculations on the data set. Reporting all values allows all of the data to be evaluated using appropriate statistical treatment. This assists in identifying any

bias in the analyses, allows better evaluation of distributions and trends in environmental data, and helps in estimating the true sensitivity of the measurement process.

The reader should use caution in interpreting individual values that are negative or less than minimum detectable levels. A negative value has no physical significance. Values less than minimum detectable levels lack statistical confidence as to what the actual number is, although it is known with high confidence that it is below the specified detection level. Such values should not be interpreted as being the actual amount of material in the sample, but should be seen as reflecting a range (from zero to the minimum detectable level) in which the actual amount would likely lie. These values are significant, however, when taken together with other analytical results that indicate that the distribution is near zero.

The data provided in this report are provided as a matter of courtesy and should not be construed as an application for a permit or license, or in support of such an application. Approval of the Department of Energy should be obtained before publication of any data contained in this report.

Abbreviations used within this report are as defined.

Abbreviations

C Average	Average concentration
C Maximum	Maximum concentration
C Minimum	Minimum concentration
m^3	Cubic meter
m/s	Meters per second
mCi	Millicurie
mg/l	Milligrams per liter
mrem	Millirem
pCi/l	Picocuries per liter
pCi/m^3	Picocuries per cubic meter
pH	Hydrogen ion concentration
SU	Standard Unit
$\mu g/m^3$	Micrograms per cubic meter
#/100 ml	Number per 100 milliliter
µCi	Microcurie

Table 1

Plutonium and Americium Airborne Effluent Data

Month	Plutonium-239, -240 (02/14/92 - 03/16/92) Release (µCi)	C Maximum (pCi/m³)	Americium-241 (02/14/92 - 03/16/92) Release (µCi)	C Maximum (pCi/m³)
January	0.030 ± 0.007	0.0005 ± 0.0001	0.0075 ± 0.0030	0.0006 ± 0.0001
February	0.017 ± 0.007	0.0002 ± 0.0001	0.0076 ± 0.0032	0.0001 ± 0.0001
March	0.018 ± 0.007	0.0001 ± 0.0000	0.0008 ± 0.0039	0.0001 ± 0.0000
April	0.029 ± 0.008	0.0001 ± 0.0000	0.0046 ± 0.0044	0.0000 ± 0.0000
May	0.220 ± 0.035	0.0030 ± 0.0006	0.0070 ± 0.0100	0.0002 ± 0.0001
June	0.036 ± 0.007	0.0001 ± 0.0000	0.0093 ± 0.0032	0.0000 ± 0.0000
July	0.097 ± 0.016	0.0009 ± 0.0002	0.0221 ± 0.0076	0.0002 ± 0.0000
August	0.039 ± 0.008	0.0003 ± 0.0001	0.0092 ± 0.0054	0.0001 ± 0.0000
September	0.027 ± 0.008	0.0002 ± 0.0001	0.0080 ± 0.0036	0.0000 ± 0.0000
October	0.094 ± 0.022	0.0003 ± 0.0001	0.0307 ± 0.0068	0.0000 ± 0.0000
November	0.022 ± 0.008[a]	0.0007 ± 0.0002	0.0126 ± 0.0070[a]	0.0001 ± 0.0000
December	0.215 ± 0.035[b]	0.0006 ± 0.0001[b]	0.0310 ± 0.0102	0.0001 ± 0.0000
Year to Date	0.843 ± 0.167	0.0030 ± 0.0006	0.1500 ± 0.0680	0.0006 ± 0.0001
1992				
January	[c]	[c]	[c]	[c]
February	[c]	[c]	[c]	[c]
March	[c]	[c]		

a These values have been corrected because of adjusted flow data.
b Previously reported as incomplete analysis.
c Incomplete laboratory analysis.

Table 2

Uranium Airborne Effluent Data

Month	Uranium-233, -234 (02/14/92 - 03/17/92) Release (µCi)	Uranium-233, -234 (02/14/92 - 03/17/92) C Maximum (pCi/m³)	Uranium-238 (02/14/92 - 03/17/92) Release (µCi)	Uranium-238 (02/14/92 - 03/17/92) C Maximum (pCi/m³)
January	0.003 ± 0.013	0.0001 ± 0.0001	0.020 ± 0.013	0.0002 ± 0.0001
February	0.004 ± 0.013	0.0001 ± 0.0000	0.001 ± 0.011	0.0001 ± 0.0000
March	0.026 ± 0.021	0.0001 ± 0.0001	0.033 ± 0.012	0.0001 ± 0.0000
April	0.036 ± 0.013	0.0001 ± 0.0001	0.039 ± 0.012	0.0002 ± 0.0001
May	0.143 ± 0.029	0.0001 ± 0.0001	0.163 ± 0.030	0.0001 ± 0.0001
June	0.127 ± 0.023	0.0001 ± 0.0001	0.147 ± 0.021	0.0003 ± 0.0001
July	0.080 ± 0.018	0.0001 ± 0.0001	0.119 ± 0.018	0.0005 ± 0.0002
August	0.032 ± 0.019	0.0001 ± 0.0001	0.076 ± 0.019	0.0002 ± 0.0001
September	0.041 ± 0.019	0.0001 ± 0.0001	0.063 ± 0.020	0.0001 ± 0.0001
October	0.079 ± 0.031	0.0001 ± 0.0001	0.173 ± 0.034	0.0002 ± 0.0001
November	0.035 ± 0.021[a]	0.0001 ± 0.0001	0.097 ± 0.026[a]	0.0002 ± 0.0001
December	0.024 ± 0.014[b]	0.0001 ± 0.0000	0.070 ± 0.019[b]	0.0002 ± 0.0001
Year to Date	0.629 ± 0.233	0.0001 ± 0.0001	1.002 ± 0.235	0.0005 ± 0.0002
1992				
January	[c]	[c]	[c]	[c]
February	[c]	[c]	[c]	[c]
March	[c]	[c]	[c]	[c]

a These values have been corrected because of adjusted flow data.
b Previously reported as incomplete data.
c Incomplete laboratory analysis.

Table 3

Tritium and Beryllium Airborne Effluent Data

Month	Tritium, H-3 (03/01/92 - 03/31/92) Release (mCi)	C Maximum (pCi/m^3)	Beryllium (02/14/92 - 03/17/92) Release (grams)	C Maximum ($\mu g/m^3$)
January	0.082	19 ± 8	0.1468 ± 0.011	0.00059
February	0.147	30 ± 18	0.1212 ± 0.009	0.00049
March	0.179	27 ± 9	0.1051 ± 0.007	0.00032
April	0.358	40 ± 17	0.1300 ± 0.008	0.00184
May	0.121	21 ± 6	0.1016 ± 0.007	0.00043
June	0.450	94 ± 55	0.2200 ± 0.014	0.00065
July	0.857	68 ± 10	0.0893 ± 0.006	0.00034
August	0.483	61 ± 13	0.0695 ± 0.004	0.00022
September	0.330	46 ± 15	0.0802 ± 0.005	0.00062
October	0.674	50 ± 8	0.0608 ± 0.004	0.00076
November	0.479	92 ± 17	0.0629 ± 0.004	0.00029
December	0.600[a]	35 ± 16	0.0664 ± 0.004	0.00039
Year to Date	4.760	94 ± 55	1.2538 ± 0.083	0.00184
1992				
January		[b]	[b]	
February		[b]	[b]	
March		[b]	[b]	

NOTE: Beryllium measured at the remaining 44 locations was below the screening level of 0.1 gram per month. Beryllium emissions from Rocky Flats Plant are regulated by the State of Colorado under Colorado Air Quality Control Regulation #8. The limit for beryllium air emissions is 10 grams per stationary source in a 24-hour period.

The calibration methodology for the beryllium analyses was changed beginning with the September 1990 samples to improve quality assurance. The previous procedure used the single-point, "simple method of additions," one of the methods recommended by the manufacturer of the graphite furnace atomic absorption analytical equipment. The current method is based on EPA Contract Laboratory Program protocol. It uses multi-point calibration curves, periodic validation of the curve with EPA validation standards, and periodic blank and sample checks to assure absence of equipment contamination and matrix effects during the analysis. No blank corrections are made to any beryllium data.

a Reflects a revised release value due to corrected effluent volumes for one sampling period.
b Incomplete lab analysis.

Table 4

Plutonium Concentrations in Ambient Air for Onsite Samplers

(02/17/92 - 03/30/92)

Location	Number Composited Monthly Samples	Volume (m^3)	Plutonium Concentration (pCi/m^3)	± 95 percent Confidence Interval (pCi/m^3)
S-01[a]				
S-02[a]				
S-03[a]				
S-04[a]				
S-05[a]				
S-06[a]				
S-07[a]				
S-08[a]				
S-09[a]				
S-10[a]				
S-11[a]				
S-13[a]				
S-14[a]				
S-16[a]				
S-17[a]				
S-18[a]				
S-19[a]				
S-20[a]				
S-21[a]				
S-22[a]				
S-23[a]				
S-24[a]				
S-25[a]				
S-81[a]				

a Incomplete laboratory analysis.

Table 5

Plutonium Concentrations in Ambient Air for Perimeter Samplers

(02/25/92 - 03/24/92)

Location	Number Composited Monthly Samples	Volume (m^3)	Plutonium Concentration (pCi/m^3)	± 95 percent Confidence Interval (pCi/m^3)
S-31[a]				
S-32[a]				
S-33[a]				
S-34[a]				
S-35[a]				
S-36[a]				
S-37[a]				
S-38[a]				
S-39[a]				
S-40[a]				
S-41[a]				
S-42[a]				
S-43[a]				
S-44[a]				

[a] Incomplete laboratory analysis.

Table 6

Plutonium Concentrations in Ambient Air for Community Samplers

(02/26/92 - 03/25/92)

Location	Community Name	Number Composited Monthly Samples	Volume (m^3)	Plutonium Concentration (pCi/m^3)	± 95 percent Confidence Interval (pCi/m^3)
S-51[a]	Marshall				
S-52[a]	Jeffco Airport				
S-53[a]	Superior				
S-54[a]	Boulder				
S-55[b]	Lafayette				
S-56[a]	Broomfield				
S-57[b]	Walnut Creek				
S-58[a]	Wagner				
S-59[a]	Leyden				
S-60[a]	Westminster				
S-61[c]	Denver				
S-62[a]	Golden				
S-68[a]	Lakeview Pointe				
S-73[a]	Cotton Creek				

a Incomplete laboratory analysis.

b This sampler was damaged beyond repair and must be replaced.

c Sampler S-61 located in Denver was inoperative during this period. This sampler has been temporarily removed because of construction activities on the building where it is installed.

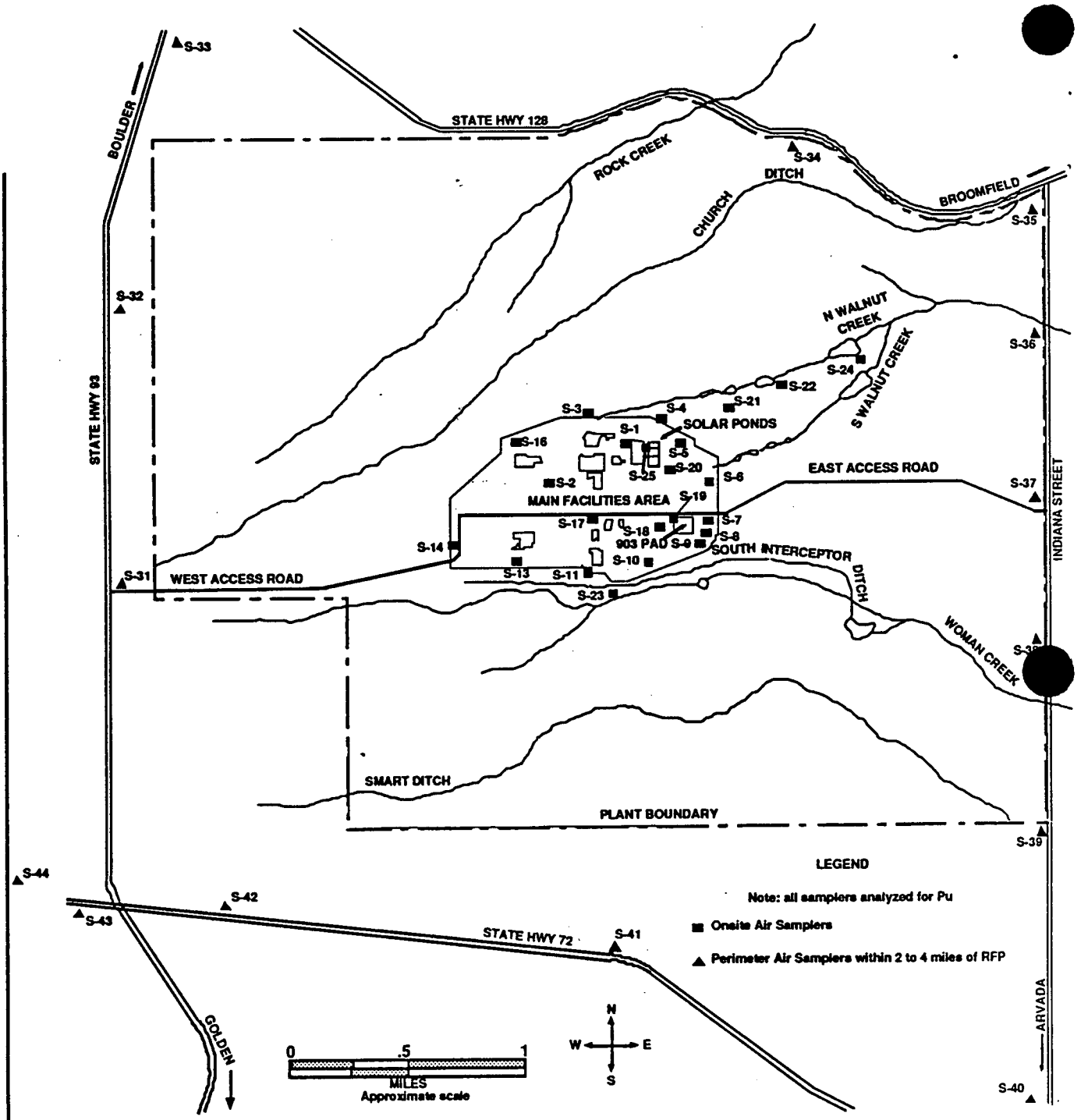


Figure 1: Location of Onsite and Perimeter Air Samplers

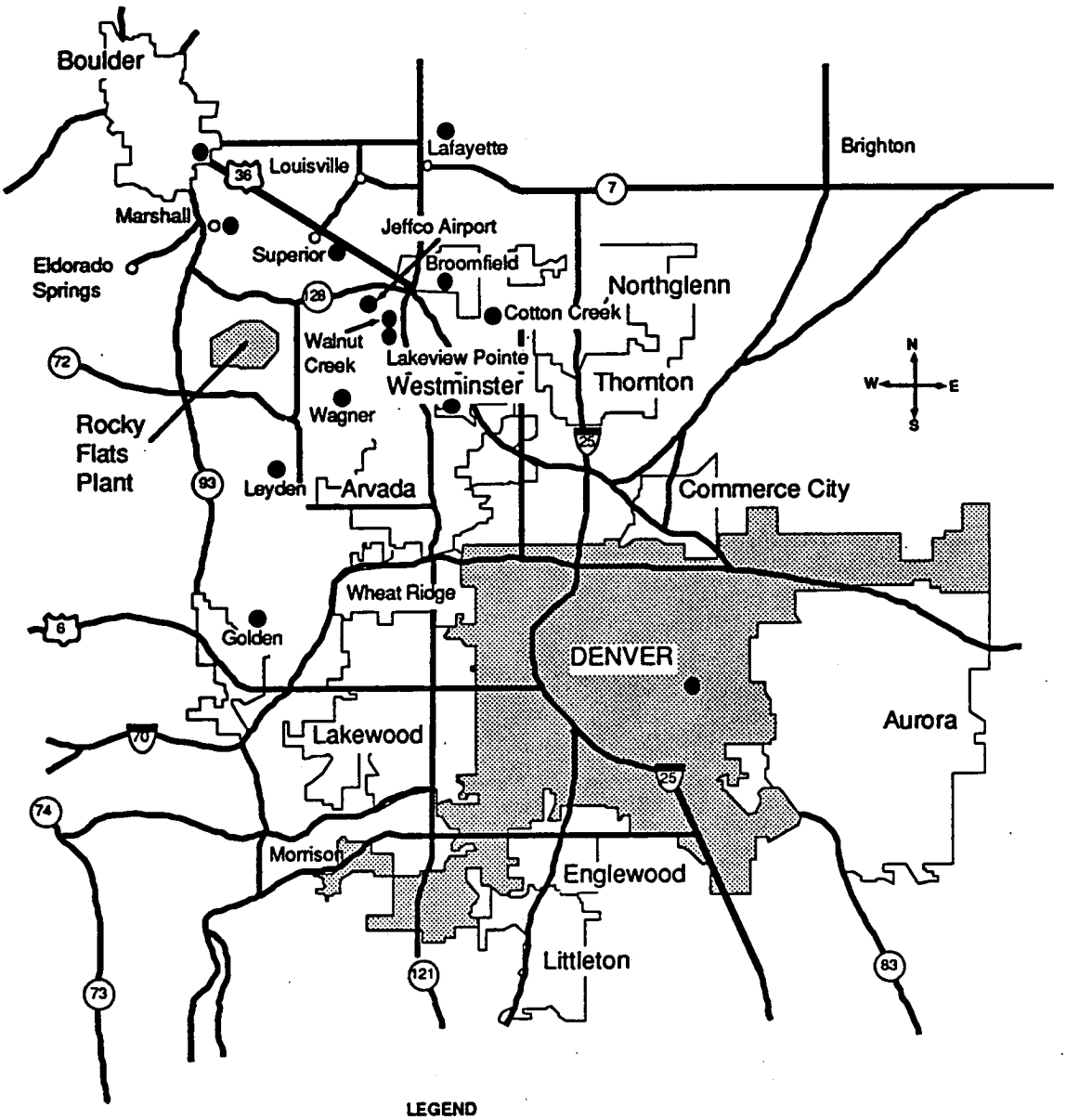


Figure 2: Location of Community Air Samplers

Table 7

Onsite Water Sample Results - Plutonium and Americium

Holding Pond Outfall (pCi/l)

Location	Plutonium-239, -240	Americium-241
Pond A-4		
03/14/92 - 03/20/92	a	a
03/21/92 - 03/27/92	a	a
03/28/92 - 04/03/92	a	a
Volume weighted average concentration	a	a
Pond B-5 - No discharge.		
Pond C-1		
02/29/92 - 03/06/92	a	-0.001 ± 0.002
03/07/92 - 03/13/92	a	a
03/14/92 - 03/20/92	a	a
03/21/92 - 03/27/92	a	a
03/28/92 - 04/03/92	a	a
Average concentration	a	a
Pond C-2		
03/24/92 - 03/27/92	a	a
03/28/92 - 04/03/92	a	a
Volume weighted average concentration	a	a
Walnut Creek at Indiana		
03/05/92 - 03/06/92[b]	a	-0.003 ± 0.002
03/06/92 - 03/13/92[b]	a	a
03/14/92 - 03/20/92	a	a
03/21/92 - 03/27/92	a	a
03/28/92 - 04/03/92	a	a
Volume weighted average concentration	a	a

a Incomplete lab analysis.
b Flow from precipitation events.

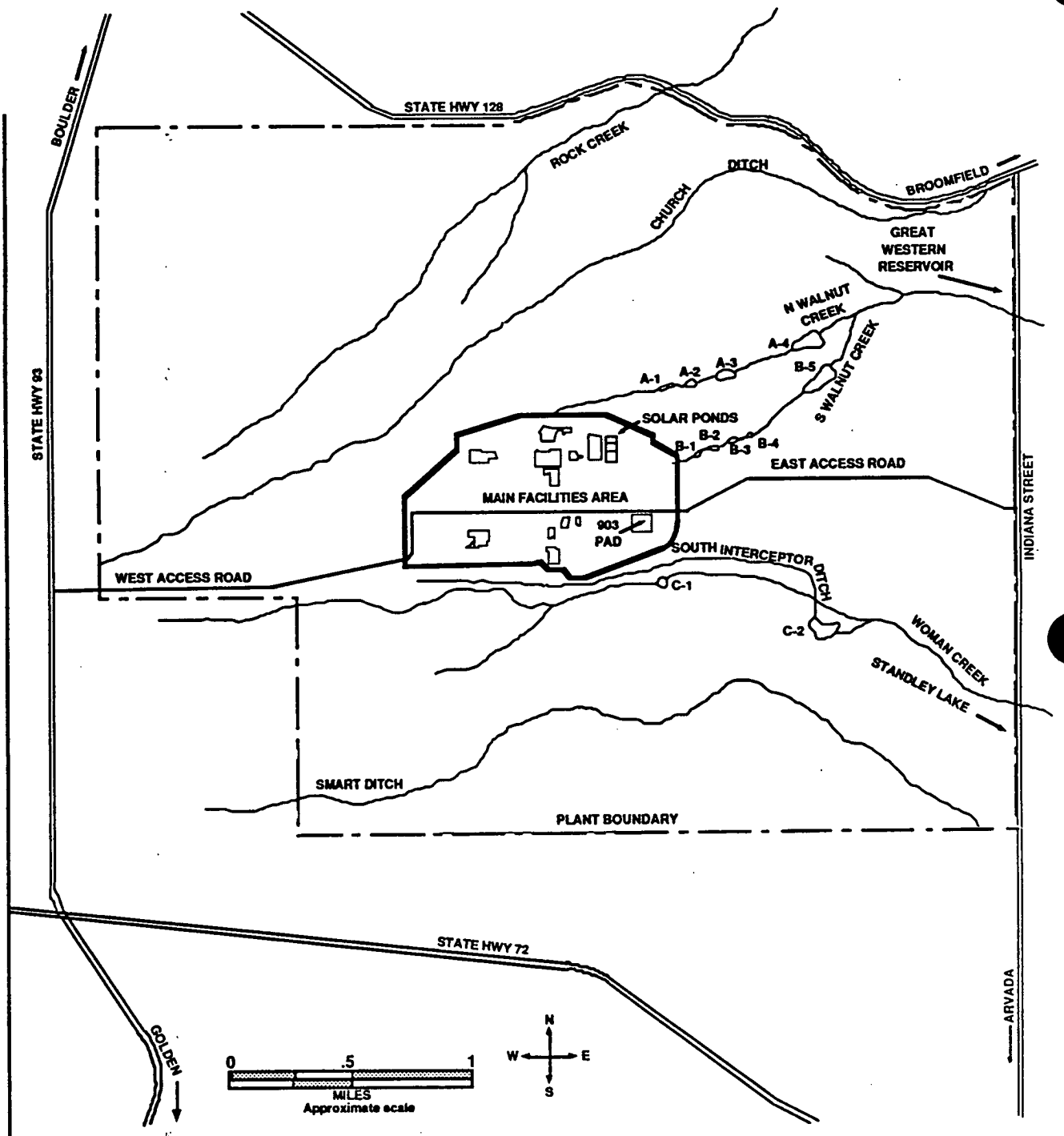
Table 8

Onsite Water Sample Results - Uranium

Holding Pond Outfall (pCi/l)

Location	Uranium-233, -234		Uranium-238	
Pond A-4				
03/14/92 - 03/20/92	a		a	
03/21/92 - 03/27/92	a		a	
03/28/92 - 04/03/92	a		a	
Volume weighted average concentration	a		a	
Pond B-5 - No discharge.				
Pond C-1				
02/29/92 - 03/06/92	0.73	0.10	0.41	0.08
03/07/92 - 03/13/92	a		a	
03/14/92 - 03/20/92	a		a	
03/21/92 - 03/27/92	a		a	
03/28/92 - 04/03/92	a		a	
Average concentration	a		a	
Pond C-2				
03/24/92 - 03/27/92	a		a	
03/28/92 - 04/03/92	a		a	
Volume weighted average concentration	a		a	
Walnut Creek at Indiana				
03/05/92 - 03/06/92[b]	0.73 ±	0.10	0.63 ±	0.10
03/06/92 - 03/13/92[b]	a		a	
03/14/92 - 03/20/92	a		a	
03/21/92 - 03/27/92	a		a	
03/28/92 - 04/03/92	a		a	
Volume weighted average concentration	a		a	

a Incomplete lab analysis.
b Flow from precipitation events.



Note: Stream flow in the Rocky Flats area is to the east.

Figure 3: Holding Pond and Liquid Effluent Water Courses

Table 9

Offsite Water Sample Results - Plutonium and Americium

Location	Number of Samples	Plutonium-239, -240	Americium-241
Reservoirs (pCi/l)			
Great Western	1[a]	[b]	[b]
Standley Lake	1[a]	[b]	[b]
Community Tap Water (pCi/l)			
Boulder	1[a]	[b]	[b]
Broomfield	1[a]	[b]	[b]
Westminster	1[a]	[b]	[b]
Arvada	1	[b]	[b]
Denver	1	[b]	[b]
Golden	1	[b]	[b]
Lafayette	1	[b]	[b]
Louisville	1	[b]	[b]
Thornton	1	[b]	[b]

[a] Plutonium and Americium analyses are performed on one sample composited from four weekly grab samples.
[b] Incomplete lab analysis.

Table 10

Offsite Water Sample Results - Uranium

Reservoirs (pCi/l)

Location	Number of Samples	Uranium-233, -234	Uranium-238
Great Western	1[a]	b	b
Standley Lake	1[a]	b	b

Community Tap Water (pCi/l)

Boulder	1[a]	b	b
Broomfield	1[a]	b	b
Westminster	1[a]	b	b
Arvada	1	b	b
Denver	1	b	b
Golden	1	b	b
Lafayette	1	b	b
Louisville	1	b	b
Thornton	1	b	b

a Uranium analyses are performed on one sample composited from four weekly grab samples.
b Incomplete lab analysis.

Table 11

Onsite and Offsite Water Sample Results - Tritium

		Tritium (pCi/l)		
Location	Number of Samples	C Miniumum	C Maximum	C Average
Pond A-4[b]	a	a	a	a
Pond C-1	a	a	a	a
Pond C-2[b]	a	a	a	a
Boulder	a	a	a	a
Broomfield	a	a	a	a
Great Western	a	a	a	a
Standley Lake	a	a	a	a
Westminster	a	a	a	a
Walnut at Indiana[b]	a	a	a	a
Arvada	a	a	a	a
Denver	a	a	a	a
Golden	a	a	a	a
Lafayette	a	a	a	a
Louisville	a	a	a	a
Thornton	a	a	a	a

a Incomplete lab analysis.
b Volume weighted average concentration.

Table 12

Offsite Water Sample Results - Nitrate as Nitrogen

Nitrate (as N) at Great Western Reservoir

Sample Date	Nitrate (as N) (mg/l)
03/05/92	<0.02
03/12/92	<0.02
03/19/92	0.10
03/26/92	<0.02

Nitrate (as N) at Standley Lake

03/05/92	0.03
03/12/92	<0.02
03/19/92	<0.02
03/26/92	<0.02

Note: For some nonradioactive parameters, the concentrations that are measured at or below the minimum detectable concentration (MDC) are assigned to MDC. The less than symbol (<) indicates MDC values and calculated values that include one or more MDCs.

Table 13

NPDES/FFCA Permit Water Sample Results

Discharge 001-A (Pond B-3) Discharged continuously from 03/01/92 - 03/08/92 and 03/10/92 - 03/31/92.

Parameters		Measured 30-Day Average	Limit 30-Day Average	Measured Max. 7-Day Average	Limit Max. 7-Day Average
Nitrate	mg/l	3.8	10	4.2	20

		Measured Maximum	Limit Maximum
Total Residual Chlorine	mg/l	0.13	0.5

Discharge 001-B (Sewage Treatment Plant) Discharged continuously from 03/01/92 - 03/31/92.

Parameters		Measured 30-Day Average	Limit 30-Day Average	Measured Maximum	Limit Maximum
CBOD5	mg/l	2	10	3	25
Total Phosphorus	mg/l	0.2	8	1.1	12
Total Chromium	mg/l	0.008	0.05	0.009	0.10

		Measured 30-Day Average	Limit 30-Day Average	Measured Max. 7-Day Average	Limit Max. 7-Day Average
Fecal Coliforms	#/100 ml	1 (Geometric)	200 (Geometric)	1 (Geometric)	400 (Geometric)
Total Suspended Solids	mg/l	4	30	6	45

		Measured Minimum	Limit Minimum	Measured Maximum	Limit Maximum
pH	SU	6.8	6.0	7.3	9.0

	Observed Sheen	Limit Sheen
Oil and Grease	No visual	No visual

Discharge 002 (Pond A-3) Discharged continuously from 03/12/92 - 03/31/92.

Parameters		Measured 30-Day Average	Limit 30-Day Average	Measured Maximum	Limit Maximum
Nitrates as N	mg/l	2.2	10	2.3	20

		Measured Minimum	Limit Minimum	Measured Maximum	Limit Maximum
pH	SU	7.2	6.0	8.1	9.0

Table 13

NPDES/FFCA Permit Water Sample Results (Continued)

Discharge 003 (RO Pilot Plant) and Discharge 004 (RO Plant) are inactive outfalls and will be eliminated from the new NPDES permit.

Discharge 005 (Pond A-4) Discharged continuously from 03/14/92 - 03/31/92.

Parameters		Measured Maximum	Limit Maximum
Total Chromium	mg/l	<0.007	0.05

Discharge 006 (Pond B-5) No discharge.

Parameters		Measured 30-Day Average	Limit 30-Day Average	Measured Max. 7-Day Maximum	Limit Max. 7-Day Maximum
Nitrate as N[a]	mg/l		10		20

Parameters		Measured Maximum	Limit Maximum
Total Residual Chlorine[a]	mg/l		0.5
Total Chromium	mg/l		0.05

Discharge 007 (Pond C-2) Discharged continuously from 03/24/92 - 03/31/92.

Parameters		Measured Maximum	Limit Maximum
Total Chromium	mg/l	<0.007	0.05

a These parameters are measured only in the event that Waste Water Treatment Plant effluent bypasses Pond B-3 and flows directly into Pond B-5.

Table 14

NPDES/FFCA Effluent Monitoring

Discharge 001-A (Pond B-3) Discharged continuously from 03/01/92 - 03/08/92 and 03/10/92 - 03/31/92.

Parameters		Measured Maximum	Measured 30-Day Average
BOD5	mg/l	8.4	5
CBOD5	mg/l	3.3	2.4
Total Suspended Solids	mg/l	10	5

Discharge 001-B (Sewage Treatment Plant [STP]) Discharged continuously from 03/01/92 - 03/31/92.

Parameters		Measured Maximum	Measured 30-Day Average
Nirtrate as N	mg/l	7.86	3.50
Total Residual Chlorine	mg/l	0.10	0.02
Whole Effluent Toxicity[a]			
Ceriodaphnia	% Eff to LC50:	>100	
Fathead Minnows	% Eff to LC50:	78.5	

		Measured 30-Day Average
Metals		
Antimony	ug/l	<25
Arsenic	ug/l	<1.2
Beryllium	ug/l	<1
Cadmium	ug/l	0.19
Copper	ug/l	<4
Iron	ug/l	77.8
Lead	ug/l	1.4
Manganese	ug/l	26.8
Mercury	ug/l	<0.2
Nickel	ug/l	<44.9
Silver	ug/l	<0.2
Zinc	ug/l	107 (data from 3/4/92 only)

Metals were sampled on 03/04/92 and 03/11/92.

		PQL[b]	Concentrations that were above PQL
Volatile Organic Compounds (VOCs)			
No compounds found	ug/l		

Table 14

NPDES/FFCA Effluent Monitoring (Continued)

Discharge 003 (Reverse Osmosis Pilot Plant) and Discharge 004 (Reverse Osmosis Plant) are inactive outfalls and will be eliminated from the new NPDES permit.

Discharge 005 (Pond A-4) Discharged continuously from 03/14/92 - 03/31/92.

Whole Effluent Toxicity[a]

Ceriodaphnia	% Eff to LC50:	>100
Fathead Minnows	% Eff to LC50:	>100

Discharge 006 (Pond B-5) No discharge.

Whole Effluent Toxicity[a]

Ceriodaphnia	% Eff to LC50:
Fathead Minnows	% Eff to LC50:

Discharge 007 (Pond C-2) Discharged continuously from 03/24/92 - 03/31/92.

Whole Effluent Toxicity[a]

Ceriodaphnia	% Eff to LC50:	>100
Fathead Minnows	% Eff to LC50:	>100

a Results for whole effluent toxicity are given in percentage of effluent sample that will cause mortality to half the test result organisms within the time frame of the test. For example, >100 percent indicates that 100 percent pure effluent did not cause acute toxicity to at least half of the organisms. A lower percentage LC_{50} (lethal concentration to 50 percent of test organisms) indicates a greater toxic effect since less of the sample is required to observe a sufficiently extensive adverse effect.

b PQL is the Practical Quantitation Limit. It is equal to ten times the Method Detection Limit and represents the quantity at which 70 percent of laboratories can report in the 95 percent confidence interval.

Table 15

Water Sample Results, Nonradioactive Parameters

Walnut Creek at Indiana Street

Parameters		Number of Samples	C Minimum	C Maximum	C Average
pH	SU	26	7.12	8.49	N/A
Nitrates as N	mg/l	26	0.57	2.22	1.59

Flow occured 03/05/92 - 03/31/92.

Table 16

Daily Flow Data Recorded at the Walnut Creek at Indiana Gaging Station, Ponds A-4 and B-5

Date	Walnut Creek at Indiana (Gallons)	Pond A-4 (Gallons)	Pond B-5 (Gallons)
03/01/92	No Flow	No Discharge	No Discharge
03/02/92			
03/03/92			
03/04/92	No Flow		
03/05/92[a]	259,000		
03/06/92[a]	465,000		
03/07/92[a]	238,000		
03/08/92[a]	153,000		
03/09/92[a]	[b]		
03/10/92[a]	2,020,000		
03/11/92[a]	2,137,000		
03/12/92[a]	2,604,000		
03/13/92[a]	4,886,000	No Discharge	
03/14/92	5,114,000	281,000	
03/15/92	5,300,000	2,467,000	
03/16/92	5,214,000	2,994,000	
03/17/92	3,209,000	2,327,000	
03/18/92	3,394,000	3,334,000	
03/19/92	3,881,000	3,553,000	
03/20/92	3,512,000	2,061,000	
03/21/92	2,946,000	2,975,000	
03/22/92	3,044,000	2,239,000	
03/23/92	3,734,000	2,343,000	
03/24/92	2,866,000	2,743,000	
03/25/92	2,970,000	2,894,000	
03/26/92	2,734,000	2,660,000	
03/27/92	2,775,000	2,506,000	
03/28/92	5,247,000	2,302,000	
03/29/92	3,342,000	2,061,000	
03/30/92	2,974,000	2,169,000	
03/31/92	2,756,000	2,401,000	No Discharge
Total	77,774,000	44,310,000	No Discharge

[a] Flow data collected from 3/5/92 - 3/13/92 resulted from precipitation events.
[b] Exteme blizzard conditions, plant closed. No data available.

Table 17

Daily Flow Data Recorded at Ponds C-1 and C-2 (Woman Creek)

Date	Pond C-1 (Gallons)	Pond C-2 (Gallons)
03/01/92	161,000	No discharge
03/02/92	159,000	
03/03/92	153,000	
03/04/92	[a]	
03/05/92	[a]	
03/06/92	[a]	
03/07/92	[a]	
03/08/92	[a]	
03/09/92	[a]	
03/10/92	[a]	
03/11/92	734,000[b]	
03/12/92	734,000[b]	
03/13/92	734,000[b]	
03/14/92	734,000[b]	
03/15/92	734,000[b]	
03/16/92	734,000[b]	
03/17/92	734,000[b]	
03/18/92	734,000[b]	
03/19/92	734,000[b]	
03/20/92	734,000[b]	
03/21/92	734,000[b]	
03/22/92	734,000[b]	
03/23/92	734,000[b]	No discharge
03/24/92	734,000[b]	544,600
03/25/92	734,000[b]	1.042,300
03/26/92	734,000[b]	1,121,800
03/27/92	698,000	1,076,800
03/28/92	710,000	1,178,600
03/29/92	734,000[b]	1,172,100
03/30/92	734,000[b]	1,135,300
03/31/92	734,000[b]	1,208,400
Total	15,827,000	8,479,900

[a] Power outage to flow measurement device. No flow data available.
[b] Flow exceeded measurment capability. Volume is an estimate.

Table 18

Daily Transfer Flow Data Recorded for Pond B-5 to Pond A-4

Date	Pond B-5 to Pond A-4 (gallons)
03/01/92	No transfer
03/02/92	
03/03/92	
03/04/92	
03/05/92	
03/06/92	
03/07/92	
03/08/92	
03/09/92	
03/10/92	No transfer
03/11/92	462,500
03/12/92	1,190,600
03/13/92	927,700
03/14/92	724,100
03/15/92	284,200
03/16/92	739,200
03/17/92	738,500
03/18/92	729,200
03/19/92	843,100
03/20/92	853,400
03/21/92	835,200
03/22/92	824,700
03/23/92	849,600
03/24/92	980,800
03/25/92	1,026,400
03/26/92	1,003,000
03/27/92	921,300
03/28/92	942,900
03/29/92	967,000
03/30/92	96,700
03/31/92	909,900
Total	16,850,000

Site Meteorology and Climatology

Meteorological data were collected on the plantsite during March 1992 from instrumentation installed on a 61-meter (200-foot) tower located in the west buffer zone. Meteorological information in this report represents over 100 percent data recovery. Table 19 is the March 1992 summary of the percent frequency of wind directions (16 compass points) divided into four wind-speed categories. The compass point designations indicate the true bearing when facing against the wind. These frequency values are represented graphically in the accompanying wind rose. The wind rose vectors also represent the bearing against the wind (i.e., wind along each vector blows toward the center).

The high frequency of winds with a westerly component is normal at the RFP (when there are no strong synoptic systems). The low frequency of winds greater than 7 meters per second (m/s) (15.6 mph) with easterly components is also normal.

March was cold, wet, and snowy as a series of Pacific storms travelled through Colorado. The month's climatic summary is shown in Table 20. The month started out very warm, with high temperatures reaching nearly 15 ° C (59 °F) on March 1 and 2. On March 4 a storm caused thunderstorms with rainfall totaling 2.6 cm (1.04 inches). Another storm on March 8 and 9 combined with Arctic cold to produce near-blizzard conditions. Precipitation started as heavy rain and hail during the afternoon of March 8 as severe thunderstorms developed in the region. The rain quickly changed to wet snow by evening, as winds became strong from the north and northeast. Near-blizzard conditions prevailed overnight until early on March 9. Accumulation of at least 46 cm (18 inches) fell at the RFP, forcing the plant to cancel normal operations on that day. Several weaker storms on March 21 and 24 caused light rain and wet snow. Another heavy rainfall of 1.3 cm (0.52 inches) fell on March 28.

The mean wind speed for March 1992 was 3.5 m/s (7.8 mph). The highest wind gust was 25 m/s (56 mph), which occurred during the blizzard on March 8 at approximately 8:15 p.m.

The mean temperature recorded for March 1992 was 4.7 °C (40.5 °F). The maximum temperature recorded was 15 °C (59 °F), which occurred on the first two days of the month. The minimum temperature recorded was -8.3 °C (17 °F) on March 10 at approximately 6:15 a.m.

Water equivalent precipitation totaled 8.6 cm (3.37 inches) during March. The greatest daily precipitation occurred on March 8 when 2.6 cm (1.04 inches) was recorded. The record amounts on March 8 and 9 probably underestimated the actual precipitation because of persistent strong winds during precipitation.

Table 19

Rocky Flats Plant Wind Direction Frequency (Percent) by Four Wind-Speed Classes

(Fifteen-Minute Averages - March 1992)

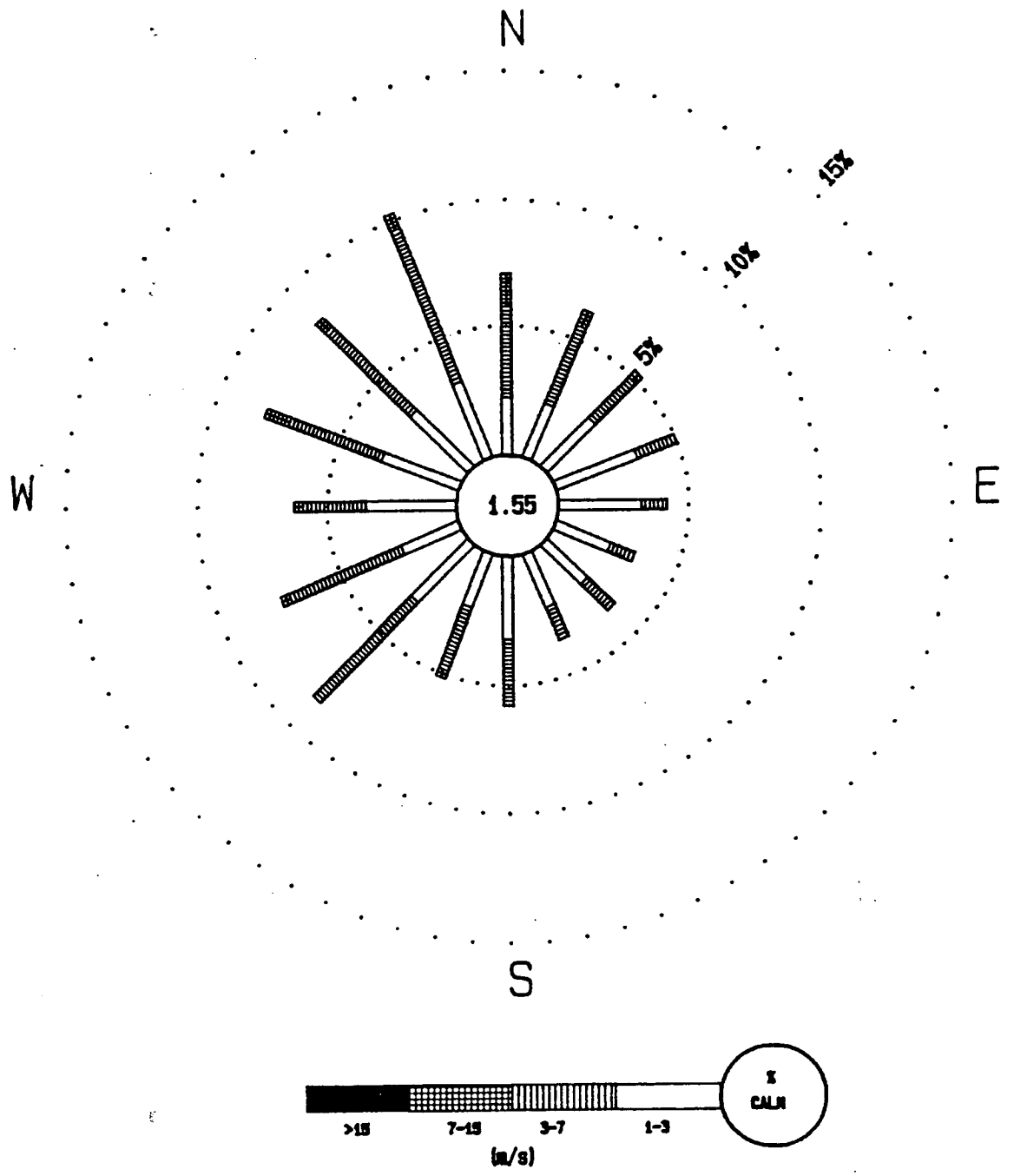
	Calm	1-3 (m/s)	3-7 (m/s)	7-15 (m/s)	>15 (m/s)	Total
-	1.55					1.55
N	-	2.26	3.64	1.18	0.07	7.14
NNE	-	2.26	3.23	0.57	0.07	6.13
NE	-	2.76	2.22	0.17	0.00	5.15
ENE	-	3.37	1.52	0.03	0.00	4.91
E	-	3.23	0.91	0.00	0.00	4.14
ESE	-	2.29	0.98	0.00	0.00	3.27
SE	-	2.29	1.35	0.00	0.00	3.70
SSE	-	2.32	1.28	0.00	0.00	3.60
S	-	3.27	2.53	0.00	0.00	5.80
SSW	-	2.32	2.56	0.20	0.00	5.08
SW	-	3.20	5.56	0.07	0.00	8.83
WSW	-	2.46	4.68	0.17	0.00	7.41
W	-	3.57	2.46	0.30	0.00	6.33
WNW	-	3.17	3.94	0.94	0.00	8.05
NW	-	3.30	4.82	0.40	0.00	8.52
NNW	-	3.30	6.60	0.64	0.00	10.55
TOTALS	1.55	45.37	48.27	4.68	0.14	100.00

Table 20

Climatic Summary

	TEMPERATURE AND DEWPOINT				WIND DATA		PRECIPITATION		PRESSURE
Date	High (°F)	Low	Mean	Dew-point	Mean (mph)	Maximum (1 sec)	Maximum (15 min)	Total Inches	Actual Mean (Millibars)
03/01/92	58.7	44.3	52.6	10.8	7.4	29.1	0	0.00	811.0
03/02/92	58.8	41.5	51.1	19.2	8.2	19.8	0.01	0.01	812.3
03/03/92	53.4	37.2	46.2	24.1	6.9	23.5	0.01	0.05	808.1
03/04/92	41.6	29.7	35.7	29.9	11.2	32.0	0.04	1.03	800.4
03/05/92	44.0	32.2	38.3	30.2	5.6	12.5	0	0.00	803.4
03/06/92	53.0	34.8	44.6	23.2	9.8	34.4	0	0.00	807.1
03/07/92	53.6	35.2	44.9	20.8	6.3	17.3	0	0.00	808.3
03/08/92	46.2	26.2	37.0	29.3	13.4	55.6	0.23	1.04	802.5
03/09/92	30.6	18.4	23.8	19.0	8.3	32.5	0.19	0.34	809.8
03/10/92	33.2	16.8	25.5	13.6	6.3	15.4	0	0.00	810.5
03/11/92	43.3	25.4	37.5	17.2	7.2	21.8	0	0.00	810.7
03/12/92	47.9	37.2	43.6	22.6	8.9	20.6	0	0.00	812.2
03/13/92	54.4	37.4	46.0	23.3	7.5	19.0	0	0.00	813.8
03/14/92	51.8	37.8	44.9	24.2	6.2	18.2	0	0.00	813.2
03/15/92	57.7	36.8	48.3	25.0	7.2	18.0	0	0.00	811.2
03/16/92	57.8	40.7	50.7	19.2	7.1	21.1	0.02	0.02	807.3
03/17/92	40.9	30.7	36.0	28.2	6.3	20.8	0	0.00	805.5
03/18/92	42.1	27.7	33.8	26.2	6.0	23.1	0	0.00	805.3
03/19/92	38.5	27.2	33.0	24.8	5.1	20.0	0.03	0.03	812.5
03/20/92	52.4	30.5	43.5	12.7	10.5	43.1	0	0.00	810.5
03/21/92	43.4	21.3	28.5	19.9	7.1	23.4	0.02	0.17	807.3
03/22/92	37.9	20.0	29.2	17.8	6.3	12.0	0	0.00	809.8
03/23/92	51.4	30.3	40.9	23.6	7.3	30.3	0	0.00	807.8
03/24/92	49.3	30.5	39.6	23.7	8.2	26.3	0.02	0.12	810.8
03/25/92	51.4	29.3	42.8	20.8	10.2	33.9	0	0.00	813.0
03/26/92	53.5	39.8	46.8	23.5	6.6	31.5	0	0.00	811.8
03/27/92	57.7	40.0	49.4	30.5	7.8	19.4	0	0.00	806.2
03 28/92	47.1	36.8	42.1	32.4	12.1	37.1	0.04	0.52	805.8
03 29/92	46.9	30.9	39.1	26.6	5.4	15.9	0	0.00	815.4
03 30/92	54.2	29.8	43.1	29.6	7.2	33.1	0	0.00	814.3
03 31/92	46.1	29.0	37.0	25.3	8.6	24.0	0.02	0.04	814.1

	MONTHLY TEMPERATURES				WIND DATA		PRECIPITATION		PRESSURE
Mean High (°F)	Mean Low	Mean	Mean Dew-point	Mean (mph)	Monthly Maximum	Monthly Maximum	Total	Monthly Average
48.4	31.8	40.5	23.1	7.8	55.6	0.23	3.37	809.4



Wind Rose for the Rocky Flats Plant - March 1992

Appendix A

Radiation Standards for Protection of the Public

Calculation of Potential Plant Contribution to Public Radiation Dose

The primary standards for protection of the public from radiation are based on radiation dose. Radiation dose is a means of quantifying the biological damage or risk of ionizing radiation. The unit of radiation dose is the rem or the millirem (1 rem = 1,000 mrem). Radiation protection standards for the public are annual standards, based on the projected radiation dose from a year's exposure to or intake of radioactive materials.

Radiation dose is a calculated value. It is calculated by multiplying radioactivity concentrations in air and water or on contaminated surfaces by assumed intake rates (for internal exposures) or by exposure times (for external exposure to penetrating radiation), then by the appropriate radiation dose conversion factors. That is:

Radiation Dose = Radioactivity Concentration x Intake Rate/Exposure Time x Dose Conversion Factor

Radioactivity concentrations can be determined either by measurements in the environment or by calculations using computer models. These computer models perform airborne dispersion/dose modeling of measured building radioactivity effluents and estimated diffuse source term emissions (e.g., from resuspension from contaminated soil areas).

DOE Radiation Protection Standards for the Public

ICRP-Recommended Standards for all Pathways:

Temporary Increase - 500 mrem-year Effective Dose Equivalent (with prior approval of DOE EH-2)

Normal Operations - 100 mrem/year Effective Dose Equivalent

EPA Clean Air Act Standards for the Air Pathway Only:

10 mrem-year Effective Dose Equivalent

Assumed intake rates and dose conversion factors used are based on recommendations of national and international radiation protection advisory organizations, such as the National Council on Radiation Protection and Measurements (NCRP) and the International Commission on Radiological Protection (ICRP).

Radioactive materials of importance in calculating radiation dose to the public from Rocky Flats Plant (RFP) activities include plutonium, uranium, americium, and tritium. Alpha radiation emissions from plutonium, uranium, and americium are primary contributors to the projected radiation dose.

DOE Derived Concentration Guides for Radionuclides of Interest at the Rocky Flats Plant

Air Inhalation:

Radionuclide	DCG (pCi/m3)
Plutonium-239, -240	0.02

Water Ingestion:

Radionuclide	DCG (pCi/l)
Plutonium-239, -240	30
Americium-241	30
Uranium-233, -234	500
Uranium-238	600
Hydrogen-3 (Tritium)	2,000,000

Potential public radiation dose commitments, which could have resulted from plant operations and from background (i.e., non-Plant) contributions, are calculated from average radionuclide concentrations measured at the Department of Energy (DOE) property boundary and in surrounding communities. Inhalation and water ingestion are the principal potential pathways of human exposure.

On February 8, 1990, DOE adopted DOE Order 5400.5, "Radiation Protection of the Public and the Environment," a radiation protection standard for DOE environmental activities (US 90). This standard incorporates guidance from the International Commission on Radiological Protection (ICRP), as well as from the Environmental Protection Agency Clean Air Act air emission standards (as implemented in 40 CFR 61, Subpart H). Included in DOE Order 5400.5 is a revision of the dose limits for members of the public. Tables of radiation dose conversion factors currently used for calculating dose from intakes of radioactive materials were issued in July 1988 (US88a, US88b). The dose factors are based on the ICRP Publications 30 and 48 methodology and biological models for radiation dosimetry. The DOE Order 5400.5 and the dose conversion factor tables are used for assessment of any potential RFP contribution to public radiation dose. On December 15, 1989, EPA published revised Clean Air Act air emission standards for DOE facilities (US89). DOE radiation standards for protection of the public are given in this Appendix and include the December 15, 1989, EPA Clean Air Act air pathway standards.

DOE Derived Concentration Guides

Secondary radioactivity concentration guides can be calculated from the primary radiation dose standards and used as comparison values for measured radioactivity concentrations. DOE provides tables of these "Derived Concentration Guides" - in Order 5400.5. Derived Concentration Guides (DCGs) are the concentrations that would result in an effective dose equivalent of 100 mrem from one year's chronic exposure or intake. In calculating air inhalation DCGs, DOE assumes that the exposed individual inhales 8,400 cubic meters of air at the calculated DCG during the year. Ingestion DCGs

assume a water intake of 730 liters at the calculated DCG for the year. The table on page 40 lists the most restrictive air and water DCGs for the principal radionuclides of interest at the RFP.

Compliance with EPA Clean Air Act Standards

To determine compliance with the EPA air emissions standards, measured airborne effluent radioactivity emissions are entered into the EPA-approved atmospheric dispersion/dose calculation computer model, AIRDOS-PC, for calculation of the maximum radiation dose that an individual in the public could receive from the air pathway only.

For comparison with the annual radiation dose standards for protection of the public, the maximum annual effective dose equivalent that a member of the public could receive as a result of RFP activities is typically less than 1 mrem, or less than 1 percent of the recommended annual standard for all pathways.

Dose Equivalent and Effective Dose Equivalent

Dose equivalent is a calculated value used to quantify radiation dose; it reflects the degree of biological effect from ionizing radiation. Differences in the biological effect of different types of ionizing radiation (e.g., alpha, beta, gamma, or x-rays) are accounted for in the calculation of dose equivalent.

Effective dose equivalent is a calculated value used to allow comparisons of total health risk (based primarily on the risk of cancer mortality) from exposures of different types of ionizing radiation to different body organs. It is calculated by first calculating the dose equivalent to those organs receiving significant exposures, multiplying each organ dose equivalent by a health risk weighting factor, and then summing those products. One millirem effective dose equivalent from natural background radiation would have the same health risk as one millirem effective dose equivalent from an artificially produced source of radiation.

References

US88a DOE/EH-0070, "External Dose-Rate Conversion Factors for Calculation of Dose to the Public," United States Department of Energy, Asst. Secretary for Environment, Safety and Health, July 1988.

US88b DOE/EH-0071, "Internal Dose Conversion Factors for Calculation of Dose to the Public," United States Department of Energy, Asst. Secretary of Environment, Safety and Health, July 1988.

US89 United States Environmental Protection Agency, Code of Federal Regulations 40 CFR 61, Subpart H, "National Emission Standards for Emissions of Radionuclides other than Radon from Department of Energy Facilities," Washington, D.C., December 15, 1989.

US90 United States Department of Energy, DOE Order 5400.5, "Radiation Protection of the Public and the Environment," Washington, D.C., February 8, 1990.

Appendix B

National Pollution Discharge Elimination System/Federal Facilities Compliance Agreement Volatile Organic Compounds

The following is a list of volatile organic compounds (VOCs) for which monitoring is required by the Environmental Protection Agency National Pollution Discharge Elimination System/Federal Facilities Compliance Agreement (NPDES/FFCA).

Compound	PQL (µg/l)	Compound	PQL (µg/l)
Benzene	5	1,3-dichloropropylene	5
Bromoform	5	Ethylbenzene	5
Methyl bromide	10	Methyl chloride	10
Carbon Tetrachloride	5	Methylene chloride	5
Chlorobenzene	5	1,1,2,2-tetrachloroethane	5
Chlorodibromomethane	5	Tetrachloroethylene	5
Chloroethane	10	Toluene	5
Chloroform	5	1,2-trans-dichloroethylene	5
Dichlorobromomethane	5	1,1,1-trichloroethane	5
1,1-dichloroethane	5	1,1,2-trichloroethane	5
1,2-dichloroethane	5	Trichloroethylene	5
1,1-dichloroethylene	5	Vinyl chloride	10
1,2-dichloropropane	5		

Appendix C

Colorado Water Quality Control Commission Standards

The Colorado Water Quality Control Commission has promulgated new standards for the Walnut Creek and Woman Creek drainages downstream from the Rocky Flats Plant. The Environmental Protection Agency has not yet written a new National Pollutant Discharge Elimination System permit that reflects these standards; however, in the spirit of the Agreement in Principle completed between the Department of Energy and the State of Colorado, the plant is attempting to meet the standards at this time.

Appendix D

Corrections and Updates for Previously Reported Information

No errata information for March.

Distribution

Federal Agencies

USDOE, RFO
Attn: R.M. Nelson, Jr.
Bldg. 115

USEPA
Attn: Dr. M. Lammering,
R. Rutherford
One Denver Place - Suite 1300
999 18th Street
Denver, CO 80202-2413

USEPA
Attn: B. Lavelle
999 18th Street, Suite 500
8 HWM-FF
Denver, CO 80202-2405

State Government Agencies

Colorado Water Conservation Board
Attn: N.C. Ioannides
823 State Centennial Building
1313 Sherman Street
Denver, CO 80203

Denver Regional Council of Governments
Attn: L. Mugler
2480 W. 27th Avenue, #200B
Denver, CO 80211

Department of Natural Resources
Attn: B. Hamlett III
1313 Sherman Street
Denver, CO 80203

Rocky Flats Environmental Monitoring Council
Attn: G. Swartz
1536 Cole Blvd., Suite 325
Denver West Office Park #4
Golden, CO 80401

City Governments

City of Arvada
Utilities Division
Attn: C. Videtich
8101 Ralston Road
Arvada, CO 80002

City of Boulder
Office of the City Manager
Attn: J. Piper, A. Struthers
P.O. Box 791
Boulder, CO 80302

City of Broomfield
Attn: H. Mahan, K. Schnoor
#6 Garden Office Center
P.O. Box 1415
Broomfield, CO 80038-1415

City of Fort Collins
Office of the City Manager
Attn: S. Burkett
300 La Porte
Fort Collins, CO 80525

City of Northglenn
Attn: T. Ambalam
11701 Community Center Drive
Northglenn, CO 80233-1099

City of Thornton
Attn: J. Ethredge, City Manager
9500 Civic Center Drive
Thornton, CO 80229-1120

City of Westminster
Attn: W. Christopher, S. Ramer
4800 W. 92nd Avenue
Westminster, CO 80030

Denver Water Department
Quality Control
Attn: J. Dice
1600 W. 12th Avenue
Denver, CO 80254

Health Departments

Boulder City/County Health Department - Division of Environmental Health
Attn: T. Douville, V. Harris
3450 Broadway
Boulder, CO 80020

Colorado Department of Health
4210 E. Eleventh Avenue
Denver, CO 80020
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American Friends Service Co.
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4615 Broadway Street
Boulder, CO 80304-0509

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Denver, CO 80202

Sierra Club - Rocky Mountain Chapter
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Golden, CO 80203

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Boulder, CO 80307

Woodward Clyde/ERCE
Attn: W. Glasgow
Stanford Place 3, Suite 415
4582 S. Ulster Street Pkwy.
Denver, CO 80237

Wright Water Engineers
Attn: J. Jones
2490 W. 26th Avenue, Suite 100A
Denver, CO 80211

Print Media

Boulder Daily Camera
Attn: G. Todd
1048 Pearl Street
Boulder, CO 80302

Denver Post
Attn: M. Obmascik
1560 Broadway
Denver, CO 80216

Longmont Times-Call
Attn: J. Paul
350 Terry Street
Longmont, CO 80501

Rocky Mountain News
Attn: B. Scanlon
400 W. Colfax Avenue
Denver, CO 80204

Other

National Center for Atmospheric Research
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